pre-processing the new data set prior to inputting into the at least one trained pattern recognition algorithm to remove one or more data elements at particular locations in the data set.

Please add the following new claims.

45--57. The method of claim 30, wherein the algorithm created from the first database is a trained pattern recognition algorithm.

57-58. The method of claim 54, wherein the algorithms created and developed from the databases are trained pattern recognition algorithms.

59. The method of claim 56, wherein the at least one algorithm created from the at least one database is a trained pattern recognition algorithm.--

REMARKS

Entry of this amendment and reconsideration of the present application, as amended, are respectfully requested.

Receipt and consideration of the Information Disclosure Statements filed January 3, 2000 and February 14, 2001 are respectfully requested.

Claims 1-56 and new claims 57-59 are presently active in this application.

Claims 1, 2, 6, 7, 11, 25, 28, 29, 31 and 40-46 are amended herein. In spite of the amendments to these claims, applicants reserve the right to traverse the Examiner's rejections of the claims as previously set forth and the Examiner's positions set forth in the Office Action, e.g., by filing a continuation application with such claims.

Oath/Declaration

Submitted herewith are Supplemental Declaration forms. It is noted that Declaration/Power of Attorney forms were filed January 3, 2000 in connection with a Response to a Notice to File Missing Parts.

Specification

The application has been amended to remove the illustration designated "Chart 1" from page 75 of the specification and this chart is now included as Fig. 12. The specification has been amended accordingly

at page 75, lines 9-10 and at page 20, line 19. A separate Letter to Draftsperson relating to the insertion of Fig. 12 accompanies this amendment.

No new matter has been added and no new issues are raised by the changes to the specification and presentation of new Fig. 12.

Claims

Claims 1-56 were rejected under 35 U.S.C. §102(b) as being anticipated by Corrado et al. (U.S. Pat. No. 5,482,314).

The Examiner's rejection is respectfully traversed, partially in view of amended independent claims 1, 28 and 45.

Claims 1, 28 and 45

Claims 1, 28 and 45 have been amended to specify that a trained pattern recognition algorithm is created from at least one database and which is capable of producing an output indicative of the occupancy state of the seat upon inputting a data set representing the current occupancy state of the seat.

Corrado et al. does not teach or suggest use of such a trained pattern recognition algorithm for occupancy state determination. Rather, Corrado et al. is based on the use of a process referred to as "sensor fusion".

Generally, Corrado et al. describes a system for sensing the presence, position and type of an occupant in a seat of a vehicle for use in enabling or disabling a related airbag activator. A preferred implementation of the system includes two or more different but collocated sensors which provide information about the occupant and this information is fused or combined in a microprocessor circuit to produce an output signal to the airbag controller. According to Corrado et al., the fusion process produces a decision as to whether to enable or disable the airbag with a higher reliability than a single phenomena sensor or non-fused multiple sensors. By fusing the information from the sensors to make a determination as to the deployment of the airbag, each sensor has only a partial effect on the ultimate deployment determination. The sensor fusion process is a crude pattern recognition process based on deriving the fusion "rules" by a trial and error process.

In a preferred embodiment of the sensor fusion process used in Corrado et al., signals from infrared and ultrasonic sensors are input into a microprocessor by means of a sensor fusion algorithm to produce an output signal (col. 7, lines 15-18). During operation, the fusion processing compares the signals to a matrix of known condition confidence values to produce a set of confidence weighted values (col. 7, lines 28-32).

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A sensor fusion process of the type described in Corrado et al. is not "trained" in that it is not taught to recognize various patterns constituted within signals by subjecting the process to a variety of examples. A definition of a trained or trainable pattern recognition algorithm is provided in the specification at page 7, lines 17-30.

To further evidence the critical difference between a trained pattern recognition algorithm as now claimed in claims 1, 28 and 45 and the sensor fusion process of Corrado et al., a Declaration of Inventor David S. Breed Under 37 C.F.R. §1.132 is attached. As set forth therein, a sensor fusion algorithm is fundamentally different than a trained pattern recognition algorithm and one skilled in the art of occupancy determination systems would not have been motivated to use a trained pattern recognition algorithm instead of the sensor fusion process of Corrado et al.

Accordingly, Corrado et al. does not teach or suggest the embodiments of the invention now set forth in claims 1, 28 and 45, as well as the embodiments of claims 2-27, 29, 40-44 and 46-53 which depend from claim 1, 28 or 45.

Claims 30-39

Corrado et al. does not disclose a method for developing a database including all of the steps of independent claim 30. In particular, Corrado et al. does not disclose testing an occupancy state determination algorithm using a second database of data sets which were not used in the creation of the algorithm and identifying the occupancy states in the second database which were not correctly identified by the algorithm. Further, Corrado et al. does not collect new data comprising similar occupancy states to the incorrectly identified states, combine this new data with the first database, create a new algorithm based on the combined database and repeating the process until the desired accuracy of the algorithm is achieved.

The use of an additional database of data sets which are not used to create the algorithm but rather to test the algorithm is not disclosed in Corrado et al. Indeed, Corrado et al. does not appear to disclose many particulars about the manner in which the sensor fusion matrix is tested.

Thus, Corrado et al. does not anticipate the embodiment of the invention set forth in independent claim 30 or claims 31-39 which depend therefrom.

Claims 54 and 55

Corrado et al. does not disclose a method for developing a database including all of the steps of independent claim 54. For example, Corrado et al. does not disclose obtaining an algorithm having a desired accuracy by selectively and individually removing transducers from a transducer set to see which combination(s) of transducers from the transducer set provides the desired accuracy.

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In accordance with this embodiment of the invention, a number of transducers are initially installed in a vehicle and used to create an algorithm. One of the transducers is then removed from the set and another algorithm obtained. By removing different transducers and different combinations of transducers from the initial transducer set, numerous algorithms are obtained. Then, it is determined which algorithm(s) having the desired accuracy can be provided by a desired number of transducers. The vehicle is then designed to accommodate this reduced number of transducers and not all of the transducers initially in the transducer set. Additional details about this procedure are set forth in the specification at page 24, line 18 to page 25, line 30.

Corrado et al. does not teach or suggest any such optimization procedure designed to enable a desired, possibly minimum number of transducers to be used for occupancy state determination. Corrado et al. states that certain sensors exists and uses those sensors. There is absolutely no consideration of excessive transducers for the formation of a sensor fusion algorithm and subsequent removal of transducers to obtain additional sensor fusion algorithms and then analysis of which combination(s) and number of transducers is sufficient to provide a desired accuracy.

In view of this deficiency, Corrado et al. does not anticipate the embodiment of the invention set forth in independent claim 54 or claim 55 which depends therefrom.

Claim 56

Corrado et al. does not disclose a method for developing a system for determining the occupancy state of the driver and passenger seats of a vehicle including all of the steps of independent claim 56. In particular, Corrado et al. does not disclose mounting ultrasonic transducers having different transmitting and receiving frequencies in a vehicle such that transducers having adjacent frequencies are not within the direct ultrasonic field of each other.

One significant advantage achieved by using ultrasonic transmitters having different transmitting frequencies is that they can all transmit simultaneously without interference between ultrasonic return signals being a major concern.

In a disclosed embodiment, Corrado et al. shows a single ultrasonic sensor used in combination with a pair of infrared sensors. Corrado et al. does not teach or suggest the use of multiple ultrasonic transducers transmitting at different frequencies.

In view of this deficiency, Corrado et al. does not anticipate the embodiment of the invention set forth in independent claim 56.

In conclusion, Corrado et al. lacks a feature of each of the independent claims as now set forth and thus cannot anticipate any of the claims of this application.

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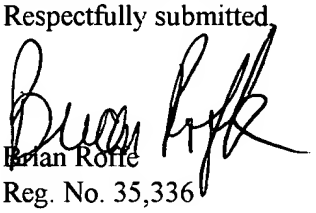
If the Examiner should determine that minor changes to the claims to obviate informalities are necessary to place the application in condition for allowance, the Examiner is respectfully requested to contact the undersigned to discuss the same.

An early and favorable action on the merits is earnestly solicited.

FOR THE APPLICANTS
Respectfully submitted,



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Encls.

Fee Transmittal Form
Version With Markings To Show Changes Made
Declaration Of Inventor David S. Breed Under 37 C.F.R. §1.132
Supplemental Declarations
Letter to Draftsperson with Fig. 12

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

U.S. PATENT APPLICATION SER. NO. 09/382,406
ACCOMPANYING AMENDMENT OF FEBRUARY 14, 2002

In The Specification:

Paragraph beginning at page 75, line 9 has been amended as follows:

The real world data consists of 12 bit, digitized signals with values between 0 and 4095. ~~Chart 1~~ FIG. 12 shows a typical raw signal. A raw vector consists of combined sections of four signals.

In The Claims:

Claims 1, 2, 6, 7, 11, 25, 28, 29, 31 and 40-46 have been amended as follows.

1. (Amended) A method of developing a system for determining the occupancy state of a seat in a passenger compartment of a vehicle, comprising the steps of:

mounting transducers in the vehicle;

forming at least one database comprising multiple data sets, each of the data sets representing a different occupancy state of the seat and being formed by receiving data from the transducers while the seat is in that occupancy state, and processing the data received from the transducers; and

creating a first, trained pattern recognition algorithm from the at least one database capable of producing an output indicative of the occupancy state of the seat upon inputting a data set representing an occupancy state of the seat.

2. (Amended) The method of claim 1, wherein said step of creating a first, trained pattern recognition algorithm from the at least one database comprises the steps of:

inputting the database into an algorithm generating program, and

running the algorithm-generating program to produce the first algorithm.

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6. (Amended) The method of claim 1, further comprising the steps of:

inputting data sets into the first, trained pattern recognition algorithm to obtain a plurality of output data, and

creating a second algorithm for combining a plurality of output data to form a new output indicative of the occupancy state of the seat.

7. (Amended) The method of claim 6, further comprising the step of:

combining the plurality of output data from the first, trained pattern recognition algorithm using a low pass filter.

11. (Amended) The method of claim 1, wherein the at least one database comprises a plurality of databases, further comprising the step of~~;~~:

providing a different distribution of occupancy states for at least one of the databases.

25. (Amended) The method of claim 1, wherein said processing step comprises the step of converting the analog data from the transducers to digital data and combining the digital data from a plurality of the transducers to form a vector comprising a string of data from each of the transducers, the first, trained pattern recognition algorithm being created such that upon inputting a vector from a new data set, the first, trained pattern recognition algorithm will produce an output representing the occupancy state of the vehicle seat.

28. (Amended) A method of developing a system for determining the occupancy state of the vehicle seat in the passenger compartment of a vehicle, comprising the steps of:

forming data sets by obtaining data representative of various occupying objects at various positions in the passenger compartment and operating on at least a portion of the data to reduce the magnitude of the largest data values in a data set relative to the smallest data values; and

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forming a database comprising multiple data sets; and

creating ~~an~~ a trained pattern recognition algorithm from the database capable of producing an output indicative of the occupancy state of the vehicle seat upon inputting a data set representing an occupancy state of the seat.

29. (Amended) The method of claim 28, wherein the step of operating on at least a portion of the data comprises the step of using an approximate logarithmic transformation function.

31. (Amended) The method of claim 30~~.~~, further comprising the step of:

creating some of the occupancy states of the seat using live human beings.

40. (Amended) The method of claim 1, further comprising the step of:

creating at least one additional algorithm from the at least one database capable of producing in combination with the first, trained pattern recognition algorithm an output indicative of the occupancy state of the seat.

41. (Amended) The method of claim 40, wherein at least one of the first, trained pattern recognition algorithm and the at least one additional algorithm identifies the category of the occupying item of the seat and another of the first, trained pattern recognition algorithm and the at least one additional algorithm determines the location within the passenger compartment of the occupying item of the seat.

42. (Amended) The method of claim 40, wherein at least one of the first, trained pattern recognition algorithm and the at least one additional algorithm uses a neural network trained for a large number of training cycles and at least one other of the first, trained pattern recognition algorithm and the

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at least one additional algorithm is a neural network trained for a substantially smaller number of training cycles.

43. (Amended) The method of claim 40, wherein at least one of the first, trained pattern recognition algorithm and the at least one additional algorithm is trained on a subset of the data in the at least one database and at least one other of said algorithms is trained on a different subset of the data in the at least one database.

44. (Amended) The method of claim 40, wherein the data set is inputted first into one of the first, trained pattern recognition algorithm and the at least one additional algorithm which determines which of the other algorithms will further process the data set.

45. (Amended) A method of developing a system for determining the occupancy state of a passenger compartment seat of a vehicle, comprising the steps of:

mounting a plurality of ultrasonic transducers in the vehicle;

receiving an analog signal from each of the transducers;

processing the analog signals from the transducers to form a data set comprising multiple data values from each transducer representative of the occupancy state of the vehicle, said data processing comprising the steps of demodulation, sampling and digitizing of the transducer data to create a data set of digital data;

forming a database comprising multiple data sets; and

creating at least one trained pattern recognition algorithm from the database capable of producing an output indicative of the occupancy state of the seat upon inputting a new data set representing an occupancy state of the seat.

46. (Amended) The method of claim 45, further comprising the step of:

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pre-processing the new data set prior to inputting into the at least one trained pattern recognition algorithm to remove one or more data elements at particular locations in the data set.

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